Process Technology for Agrochemicals
Your Ideas grow with Us!
## Everything at a Glance

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When you want a little more …

For the formulation of plant protectants, fertilizers and seed treatments using the latest technology, NETZSCH offers sophisticated state-of-the-art machines and processes.

Our design and selection of the NETZSCH technology appropriate for your production process take the aspects of economic efficiency, reliability, quality and environmental protection into account.

We engage with our customers to develop solutions and implement them with service and process-related support.

Numerous references, from laboratory to production machines to complete turnkey systems show that many international customers have put their trust in us.
Fertilizers are all naturally- or chemically-produced substrates, which are used to deliver nutrients to the soil and to ensure good plant growth.

They are applied to the plants in solid or liquid form and are essentially based on the following elements:
- Nitrogen
- Potassium
- Phosphorous

On an industrial scale, organo-mineral and mineral fertilizers are produced from these elements as well as mixtures with the elements magnesium, calcium and sulfur.

NETZSCH Grinding & Dispersing provides you with the latest technologies and processes suitable for your application.
APPLICATION TASKS, which we have successfully mastered

### DRY PROCESSING

<table>
<thead>
<tr>
<th>Product</th>
<th>Machine</th>
<th>Working capacity [kg/h]</th>
<th>Fineness [μm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen- and sulfur-based fertilizer</td>
<td>CHM 450 / 600</td>
<td>1500</td>
<td>$d_{90} &lt; 500$</td>
</tr>
<tr>
<td>Nitrogen-based fertilizer</td>
<td>$CONDUX^\circledR$ 680</td>
<td>6000</td>
<td>$d_{90} &lt; 500$</td>
</tr>
<tr>
<td>Phosphorous-based fertilizer</td>
<td>CHM 1000/1000</td>
<td>7400</td>
<td>$d_{50} = 1400$</td>
</tr>
<tr>
<td>Nitrogen-based fertilizer (urea)</td>
<td>$CONDUX^\circledR$ 450</td>
<td>3700</td>
<td>$d_{50} = 450$</td>
</tr>
<tr>
<td>Potash- and sulfur-based fertilizer</td>
<td>$CONDUX^\circledR$ 300</td>
<td>1700</td>
<td>$d_{50} = 63$ $d_{99} = 500$</td>
</tr>
</tbody>
</table>

### WET PROCESSING

<table>
<thead>
<tr>
<th>Product</th>
<th>Machine</th>
<th>Working capacity [kg/h]</th>
<th>Fineness [μm]</th>
<th>Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnesium carbonate</td>
<td>$DISCUS^\circledR$ 300</td>
<td>3000</td>
<td>$d_{90} &lt; 10$</td>
<td>Pass process</td>
</tr>
<tr>
<td>Colemanite</td>
<td>$ZETA^\circledR$ 60</td>
<td>2000</td>
<td>$d_{50} = 2,6$ $d_{99} &lt; 10$</td>
<td>Circulation process</td>
</tr>
<tr>
<td>Sulfurous liquid fertilizer</td>
<td>$ZETA^\circledR$ 60</td>
<td>400</td>
<td>$d_{90} &lt; 6$</td>
<td>Circulation process</td>
</tr>
</tbody>
</table>
Plant protectants are necessary to protect plants from pests that could compromise plant growth (insects, fungal diseases, viruses, bacteria and weeds). Apart from additives, plant protectants usually consist of one or more active substances which give them the desired properties.

Main Types
- **Fungicides** protect plants from diseases which affect production rate and quality or, in the worst case, could completely destroy the crop.
- **Herbicides** reduce the growth of weeds which affect the production rate and the quality of the crop.
- **Insecticides** protect plants against insects. Here, the pests can absorb the insecticide directly or indirectly through their food.

As a rule, plant protectants are extremely temperature-sensitive substances that place correspondingly high demands on machine and plant engineering. For the industrial production of plant protectants NETZSCH Grinding & Dispersing provides you with the latest technologies and processes suitable for your application according to the latest standards.
**APPLICATION TASKS, which we have successfully mastered**

### DRY PROCESSING

<table>
<thead>
<tr>
<th>Product</th>
<th>Machine</th>
<th>Working capacity [kg/h]</th>
<th>Fineness [μm]</th>
<th>Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Herbicide</td>
<td>CGS 16</td>
<td>2</td>
<td>(d_{50} = 2,3) &lt;br&gt;(d_{99} = 6,8)</td>
<td></td>
</tr>
<tr>
<td>Pesticide</td>
<td>CGS 71</td>
<td>620</td>
<td>(d_{50} = 5,5) &lt;br&gt;(d_{99} = 23,8)</td>
<td></td>
</tr>
<tr>
<td>Fungicide</td>
<td>CGS 16</td>
<td>6,5</td>
<td>(d_{50} = 2,2) &lt;br&gt;(d_{99} = 8,2)</td>
<td></td>
</tr>
<tr>
<td>Herbicide</td>
<td>CGS 50</td>
<td>248</td>
<td>(d_{50} = 2,7) &lt;br&gt;(d_{99} = 18)</td>
<td></td>
</tr>
<tr>
<td>Caolin</td>
<td>CSM 165</td>
<td>35</td>
<td>(d_{50} = 6) &lt;br&gt;(d_{99} = 17)</td>
<td></td>
</tr>
<tr>
<td>Insecticide</td>
<td>CSM 360</td>
<td>350</td>
<td>(d_{99} &lt; 45)</td>
<td></td>
</tr>
</tbody>
</table>

### WET PROCESSING

<table>
<thead>
<tr>
<th>Product</th>
<th>Machine</th>
<th>Working capacity [kg/h]</th>
<th>Fineness [μm]</th>
<th>Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insecticide</td>
<td>ZETA® 60</td>
<td>4400</td>
<td>(d_{50} &lt; 0,7) &lt;br&gt;(d_{90} &lt; 1,2)</td>
<td>Circulation process</td>
</tr>
<tr>
<td>Herbicide</td>
<td>DISCUS® 300</td>
<td>3000</td>
<td>(d_{50} &lt; 4,9)</td>
<td>Pass process</td>
</tr>
<tr>
<td>Fungicide</td>
<td>DISCUS® 150</td>
<td>1600</td>
<td>(d_{90} &lt; 4,0)</td>
<td>Pass process</td>
</tr>
<tr>
<td>Fungicide</td>
<td>2 x DISCUS® 300</td>
<td>2000</td>
<td>(d_{90} &lt; 2,0)</td>
<td>Pass process</td>
</tr>
<tr>
<td>Insecticide</td>
<td>NEOS 2</td>
<td>100</td>
<td>(d_{90} &lt; 5,0)</td>
<td>Circulation process</td>
</tr>
</tbody>
</table>
In seed treatment, the grain is coated with targeted growth-enhancing substances and growth-protectants during the dressing process. Consequently, the seeds are protected from disease and their optimal growth is ensured from the moment they are sown.

Depending on pest species and nutrient requirements, various formulations exist to utilize the full yield potential. Various methods are used to apply the growth-enhancing substances, such as (micro)nutrients, crop regulators and growth modulators, as well as inoculants and other growth-protectant substances, to the seeds:

- **Encapsulation** with a thick layer to obtain an even shape
- **Pelletization** – coating with protective substances and nutrients
- **Coating** with a thin, polymer-based coating that is permeable to water.

Important steps in the production of the various formulations are mixing, dispersing and fine grinding, for which NETZSCH offers you a tailor-made solution.
APPLICATION TASKS, which we have successfully mastered

WET PROCESSING

<table>
<thead>
<tr>
<th>Product</th>
<th>Scope of the System (primary components)</th>
<th>Working capacity [kg/h]</th>
<th>Fineness [μm]</th>
<th>Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suspension concentrate</td>
<td>Modular design (Ψ-Mix®, Zeta®)</td>
<td>1000</td>
<td>d_{50} &lt; 1,5, d_{99} &lt; 5</td>
<td>Circulation process</td>
</tr>
<tr>
<td>Suspension concentrate</td>
<td>Modular design (Epsilon, MasterMix®, DisCUS)*</td>
<td>1000</td>
<td>d_{50} &lt; 1,5, d_{99} &lt; 9</td>
<td>Pass process</td>
</tr>
<tr>
<td>Suspension concentrate</td>
<td>Modular design (Ψ-Mix®, Zeta®)</td>
<td>1400</td>
<td>d_{50} &lt; 2, d_{99} &lt; 10</td>
<td>Circulation process</td>
</tr>
</tbody>
</table>

* Predisersion of the primary components with MasterMix®, critical special products are dosed with Epsilon

System module for seed treatment comprising: Big-Bag Feeder, Ψ-Mix® Disperser, Zeta® 25 Agitator Bead Mill and modular platform
The Business Unit NETZSCH Grinding & Dispersing offers an extensive machine program for process-engineering, providing solutions for wet and dry grinding, mixing, dispersing and deaeration.

Long-term experience, consistent development work, daily contact with our customers and developments with more than 100 patents ensure our technical competence and further attest to our quality-consciousness.

The bundling of process-engineering expertise and the extensive machine program, ranging from laboratory to production machines to complete production lines, is unique worldwide. Whether for dry or wet preparation, we offer the best machine solution, customized to suit your particular application.
<table>
<thead>
<tr>
<th>MasterMix® Dissolver</th>
<th>PMD / PMD-VC Intensive Mixer</th>
<th>MaxShear Inline Disperser</th>
<th>Epsilon Inline Disperser</th>
<th>Ψ-Mix® Inline Disperser</th>
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<tr>
<td><strong>Fertilizer</strong></td>
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<td><strong>Plant Protection</strong></td>
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<td><strong>Seed Treatment</strong></td>
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<tr>
<td><strong>Mixing &amp; Emulsifying</strong></td>
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<tr>
<td>Alpha® Discus®  Agitator Bead Mill</td>
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<tr>
<td>Alpha® Zeta®  Agitator Bead Mill</td>
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<tr>
<td>Alpha® Neos®  Agitator Bead Mill</td>
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<tr>
<td>Alpha® Lab® Laboratory Mill</td>
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<tr>
<td>CHM  Hammer Mill</td>
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<tr>
<td>Condux®  Fine Impact Mill</td>
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<tr>
<td>CSM  Classifier Mill</td>
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<tr>
<td>ConJet®  High-density Bed Jet Mill</td>
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<tr>
<td>CGS  Fluidized Bed Jet Mill</td>
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<tr>
<td><strong>Wet Grinding</strong></td>
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<tr>
<td><strong>Dry Grinding</strong></td>
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MACHINES FOR MIXING & EMULSIFYING

**Epsilon Inline Disperser**

With the **Epsilon**, we offer a new, compact solution for producing homogeneous dispersions as required in agrochemistry, in an inline process. Here, the dispersion process takes place in an atmospherically-sealed processing chamber and is thus dust and emission free. Because of the low shear rates, the energy input is significantly lower compared to conventional rotor-stator systems, which means that even shear- and temperature-sensitive agrochemical products can be optimally processed.

**Your Benefits at a Glance**

- Sustainably reproducible product quality
- High production output through rapid powder intake
- Very low temperature increase
- Enclosed process housing
- No adhesion of dust in the circulation tank

**MaxShear Inline Disperser**

The **MaxShear** is an inline mixer with a very high shearing effect for dispersing, emulsifying and homogenizing. It is equipped with a high-speed rotor, which rotates in close proximity to a precision-machined stator, thereby creating an intensive shearing zone through which the product flows and the solids are dispersed. Combined use with standard mixing and dispersing units reduces processing times and considerably improves the quality of agrochemical products. The product is processed in continuous flow or in a circulation loop with mobile or stationary mixing tanks. The rotor and stator can be changed very easily and quickly.

**Your Benefits at a Glance**

- Due to the compact design, it is easily integrated into existing systems
- Good pumping action with low- and moderately viscous products
- Optimum dispersion results are achieved due to extremely high shearing forces, whereby the efficiency of subsequent processes is increased
Solids in Liquids

Ψ-Mix® Inline Disperser

The Ψ-Mix® inline disperser combines an alternative dispersion method, whereby the solid components are wetted on a large liquid surface, with emission and dust-free inline operation. With high productivity within a controlled process, the combination of vacuum dispersion, shearing, pressure wetting and microcavitation results in homogeneous, fine dispersions with very reproducible quality.

PMD / PMD-VC Intensive Mixer

The PMD and PMD-VC intensive mixers are stationary mixing and dispersing units for the processing of large batches. Separation of the mixing and dispersion functions results in an extremely energy-efficient process that is especially useful for batches larger than 2000 l. The compact and closed design of the intensive mixer facilitates integration into fully-automated plant designs and prevents exposure to gases and dust.

MASTERMix® Dissolver

The MASTERMix® dissolver is used for the dispersion of solids in liquids. The mixing process takes place in batches in a stationary or mobile tank. The speed of the high-speed dispersion disk is infinitely adjustable via a frequency-controlled drive.
TECHNOLOGIES FOR THE WET GRINDING of Suspensions

**Discus Grinding System**

The *Discus* grinding system represents a quantum leap in wet grinding technology with disk agitator bead mills. With the combination of the further-optimized Discus disk agitator and the NETZSCH Dcc® separator system, you are guaranteed the highest throughput rates with considerably narrower dwell time distribution and thus more intensive grinding with consistent stress intensity.

**Zeta® Grinding System**

With this technology, which is suitable for any viscosity and almost every product, you will achieve the highest product qualities and finenesses down to the nanometer range using a wide variety of grinding media from 0.2 mm to 3 mm in diameter. The enclosed horizontal agitator bead mill is designed for highest product throughput capacities and has a pin grinding system for the highest grinding intensity.

**Neos Grinding System**

The agitator bead mill with the newly-developed *Neos* grinding system stands for maximum performance, product quality and efficiency. Coupled with the reliable use of extremely small grinding media, you can achieve the required product quality with high production output and low specific energy consumption.

During the design phase, particular consideration was given to maximum cooling efficiency. As a result, it is possible to stay within the necessary temperature limits even with high power input. The optimal grinding media separation and maximum slotted pipe surface area ensure that even with small changes in processing conditions (temperature fluctuations, formulation variances, viscosity variations, etc.), the grinding process remains stable.

**Your Benefits at a Glance**

- Highest power input without product overheating
- Maximum volume throughput
- Highest cooling efficiency
- Use of extremely small grinding beads (0.1 to 0.8 mm)

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NETZSCH ALPHA® – Modular machine platform for customized solutions

The ALPHA® machine platform sets the standard in flexibility and handling and, thanks to its modularity, facilitates customer-specific solutions. One platform accepts different grinding systems – customized for the requirements of the product you will be processing.

The advantage this modular system brings you is cross-system standardization and thus the option to economically convert a machine to a new grinding system. In addition, the ALPHA® is also the platform for future NETZSCH technologies, which guarantees you long-term investment security.

The right grinding system for every application

- Common platform for all grinding systems allows easy conversion to the specific optimum process conditions
- Spatial separation of rotating machine parts and fittings that carry media ensures a high level of operational safety and allows safe access, even during operation
- All supply lines feed into the machine from the top preventing obstructions at ground level
- Self-supporting grinding chamber for optimum accessibility to the grinding area during maintenance
- ALPHA® CART service cart for removal of the grinding tank and addition of grinding media
- Easy handling and the highest level of flexibility
**PRODUCTION MACHINES**

for Dry Fine Grinding of Powders

**CONDUX® Fine Impact Mill**

The **CONDUX®** is a high-speed fine impact mill for the dry grinding of products with a Mohs hardness of up to 3 - 3.5. Equipped with a variety of grinding tools, there is always a product-optimized mill available which can also be used in pressure-shock-resistant or pressure-gas-loaded systems.

The redesigned model of the **CONDUX® CP** with an integrated classifier is used when the desired end fineness cannot be achieved with conventional pin- or blast mills. The grinding disk and classifier are joined with a torque-proof connection and are run by a common drive motor. By adjusting the height of the classifier wheel, it is possible to easily achieve variable adjustment of the separation limit.

**Your Benefits at a Glance**

- Grinding finenesses from $d_{97}$ 50 µm to 600 µm
- Pressure-shock-resistance (optional)
- Dust-/Gas-tight design
- Good accessibility for easy cleaning
- Particle size limitation possible (model with classifier)

**CSM Classifier Mill**

Grinding in the CSM classifier mill, which combines a mechanical impact mill with an integrated air classifier, takes place between a peripheral grinding track and the rotating beater unit. With the aid of the integrated classifier wheel, final grain sizes free of oversized particles can be achieved, without the drawback of an external grinding/classifying cycle. The self-adjusting internal circulation of the coarse material in the classifier mill results in stable operation with the best possible utilization of energy.

**Your Benefits at a Glance**

- Finenesses from $d_{97}$ 20 µm to 150 µm
- Pressure-shock-resistance (optional)
- Dust-/Gas-tight design (optional)
- Good accessibility for easy cleaning
- Upper grain size limitation possible (model with classifier)
- Very high fineness attainable with precise upper grain size limitation (free of oversized particles)
The CHM Hammer Mill is an impact mill with a rotating beater unit. It is used for crushing relatively brittle or fibrous products in the fertilizer sector. End finenesses of approx. 0.5 mm - 10 mm are among the most common target requirements.

Contamination-free fine grinding of dry products of any hardness is possible with the CGS fluidized bed jet mill with integrated classifier (finenesses of d₉₀ 2.5 µm to 120 µm). Through the specialized milling principle, product grinding is entirely autogenous. Gas jets alone create the grinding energy, so there is no wear on the grinding tools. Even extremely temperature-sensitive products can be processed reliably under continuous operation.

The ConJet® high-density bed jet mill combines a spiral jet mill with an integrated classifier wheel. With this combination, the highest fineness levels (d₉₀ 2.5 µm to 70 µm) are attained independent of the product load and as a consequence, throughput capacities are higher. Adjustment of the grinding fineness is now only carried out by setting the speed of the classifier wheel. Residue-free grinding and minimal product build-up inside the machine are additional features of the ConJet®. Thanks to the compact design, the machine is extremely easy to maintain and to clean completely when changing products.
For a customized solution to meet the requirements of your application in the fertilizer, plant protection or seed treatment sector, we stand ready to provide process-related consultation and to offer you the appropriate equipment.

Whether you need a complete turn-key solution or just advice on a particular aspect of process engineering and plant construction, we have the required know-how. For more than 100 years, NETZSCH has applied the latest machine and process technology for system design and construction. We take on and carry out projects for companies around the world.

From start to finish, you can depend on our professional project management. We have the means and the capabilities to manage even the most extensive project as a unit and we are committed to maintaining the highest standards at all times.

From the planning stage to commissioning and beyond, NETZSCH will always be there for you.
Advantages of the NETZSCH Skid Systems

- Significantly less space required compared to conventional plant layouts
- Flexibility due to modular construction
- Easier and cheaper transport
- Immediate operational readiness due to complete pre-installation
- Clearly defined interfaces with respect to material flow and data media
- Easily expandable
- Use is independent of location
- Minimal effort required for cleaning with small amount of cleaning solution thanks to compact design
- Shortened production time and reduction of energy consumption (by 20-30%) due to the application of individualized technology and process for predispersion
- Improved reproducibility thanks to total automation
- Process data acquisition for quality control
Mixing, emulsifying and deaeration are basic operations in mechanical process engineering. These are the means by which at least two starting substances are combined to form a new substance which must be as homogeneous as possible, with no air or gas pockets. The process takes place both in stand-alone machines for the production of small batches and on complete production lines with extensive peripherals for the production of large batches.

For the grinding of agrochemical material systems, NETZSCH offers a comprehensive machine program of laboratory and production machines up to complete production plants. Customized for every application, NETZSCH provides you with a wide range of machines and systems.
MIXING, EMULSIFYING & WET GRINDING
for high levels of homogeneity and finenesses into the nanometer range

Your Benefits at a Glance

- High production capacity
- High, consistent product quality
- High degree of reproducibility
- High level of process reliability
- Resource-optimized process design
- High level of flexibility and process variability
- Easy maintenance
- Residue-free cleaning concepts
- Enclosed emission-free systems
- Detailed process documentation
- Clean-in-Place solutions

System example with Ψ-Mix® Inline Disperser, Discus® Agitator Bead Mill and MaxShear Inline Disperser
For the processing of dry and temperature-sensitive products by fine and ultra-fine grinding, NETZSCH has extensive experience and a diverse machine program for any desired end fineness. To complement our existing machine program, we also offer high-performance classifiers for the finest products and exact limitation of the upper particle size, which also guarantee sustainable reproducibility and high quality.

- From the single mill to the complete turn-key grinding system
- Pressureless or dust-ignition-proof systems with a pressure shock resistance of up to 10 bar (g) or even inert gas plants
- Varied range of materials including high-grade steels with polished surfaces or wear-protected concepts

NETZSCH can offer you the right solution!
Your Benefits at a Glance

- Enclosed, emission-free systems
- Products free of oversized particles with a steep particle size distribution
- Closed loop gas circulation
- For temperature-sensitive products
- High and consistent product quality in a stable process and reliable continuous operation
- High degree of reproducibility
- High production capacities
- Wear-protected models possible
- Resource-optimized process design
- Good accessibility for easy service and maintenance
- Detailed process documentation

Example of a circulating gas system with CSM classifier mill
Business Unit Grinding & Dispersing –
The World’s Leading Grinding Technology

The NETZSCH Group is a mid-sized, family-owned German company engaging in the manufacture of machinery and instrumentation with worldwide production, sales, and service branches. The three Business Units – Analyzing & Testing, Grinding & Dispersing and Pumps & Systems – provide tailored solutions for highest-level needs. Over 3,500 employees at 210 sales and production centers in 35 countries across the globe guarantee that expert service is never far from our customers.